

FROM PLANNING TO MANAGEMENT & ASSESSMENT: THE MAY RIVER WATERSHED ACTION PLAN, BLUFFTON, SC

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Abstract. Prior to exponential growth in the early to mid-2000s, shellfish harvesting was possible throughout the length of the May River located in Bluffton, SC. However, in 2007, SC Department of Health and Environmental Control reported rising fecal coliform levels in the May River headwaters, resulting in a shellfish harvesting classification down-grade to nearly one-third of the river's length in 2009. In response to this down-grade, the Town of Bluffton with its community partners committed to take action to restore shellfish harvesting and to prevent further degradation to the river by developing a watershed management plan based upon the EPA's methodology (EPA, 2008). The resulting May River Watershed Action Plan (AMEC, 2011) was adopted by Town Council in November 2011 as a guiding document for stormwater management and May River watershed restoration and protection.

Now that the May River Watershed Action Plan (Action Plan) has been implemented for nearly three (3) years, a number of activities, programs and projects have been accomplished and are on-going throughout the watershed including, but not limited to,

- creating a May River Watershed Action Plan Advisory Committee,
- increasing social marketing efforts via social media and continued watershed branding,
- completing targeted outreach,
- encouraging alternative development patterns via Low Impact Development (LID) design alternative incentives and by designating intended growth areas,
- completing a stormwater Best Management Practice (BMP) project in an undeveloped area,
- initiating a stormwater BMP retrofit project in a densely developed area,
- continuing a stormwater management program, and
- assessing the potential water quality improvement impact of a habitat restoration project.

Following the EPA template, the Action Plan was always intended to be a "living document" that not only allows for the incorporation of new information and technology, but also assesses the impact of completed projects and on-going programs to further refine the plan if needed. As the Town continues with the implementation of the Action Plan, it has also entered a concurrent phase of the plan's life – adaptive management and holistic watershed assessment by evaluating the individual and combined impact of these projects and programs on water quality improvements within the May River.

Continuous analysis of the success of any watershed management plan is crucial to keeping a plan current with ever-changing technical knowledge and a variable physical environment. This assessment of the Action Plan serves as an example of adaptive watershed management and shares the knowledge gained to date with others who face the task of stormwater, watershed or water quality management for consideration in their programs to manage natural resources.

INTRODUCTION

In response to rising fecal coliform levels, the Town of Bluffton's process to develop and initiate the implementation of a watershed-based plan for the May River watershed (HUC 3060110-03) has been previously documented (Jones and Bullman, 2012 and 2014). The May River Watershed Action Plan (Action Plan) has been the guiding document for the Town's stormwater management and water quality improvement projects, programs and initiatives for nearly three (3) years. With a number of accomplishments to date, it is now time to begin to objectively assess their success in improving water quality and adjust the Action Plan if needed. Thus, this paper documents a local example of implementing "Step #6 Measure Progress and Make Adjustments" of the EPA's *Handbook for Developing Watershed Plans to*

Restore and Protect Our Waters (EPA, 2008) as part of an adaptive management strategy.

This assessment process and the lessons learned are pertinent for stormwater, water resource, and watershed managers whose goal is to implement and assess a comprehensive approach to either protect an un-impacted waterbody or to respond to a Clean Water Act Section 303(d) listed waterbody. In South Carolina alone, the South Carolina Department of Health and Environmental Control (SCDHEC) states there are 1,108 Total Impairments among 920 Impaired Sites within the state's waterways (draft SCDHEC, 2014).

The adaptive management strategy provides managers a tool to effectively assess and modify their watershed management plans in response to ever-changing environmental conditions, an increasing technical knowledge base, increasing implementation costs with decreasing funding sources and a constant demand for action and positive results.

PROJECT DESCRIPTION

Background and related work

The May River is a regionally significant, tidal embayment waterbody. It is considered to be significant for a number of reasons including its diverse finfish and shellfish resources that are directly harvested by local and regional residents; its aesthetics and views that continue to increase the popularity of Bluffton for commercial, residential, and tourist visitation and growth; and its contribution to community character and pride that is locally and regionally recognized. It is classified by SCDHEC as an Outstanding Resource Water (SCDHEC, 2012).

Established in 1825, the Town of Bluffton, SC was a one square mile coastal village located along the banks of the May River until exponential annexation and population growth occurred causing its population and associated housing units to increase 883% and 976%, respectively, in a decade (U.S. Census Bureau, 2000 and 2010). As of 2014, the town has grown to nearly 55 square miles.

Associated with this growth was an increase in fecal coliform concentrations detected at a shellfish monitoring station in the headwaters of the May River. In 2009 a shellfish harvesting classification down-grade was made by SCDHEC due to the fecal coliform concentrations exceeding acceptable standards for human consumption of shellfish. The initial shellfish harvesting closure affected nearly one-third (1/3) the length of the May River.

The Town's subsequent watershed management planning process, based upon EPA recommendations

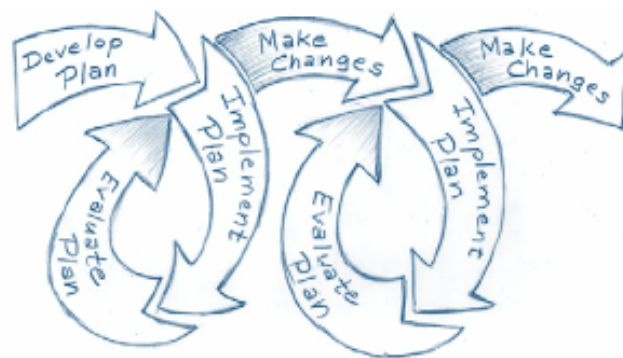


Figure 1. Iterative process of adaptive management.

(EPA, 2008), that created the May River Watershed Action Plan, as well as the Action Plan's initial accomplishments, have been previously presented and documented (Jones and Bullman, 2012 and 2014), respectively. Since the Action Plan's adoption by Town Council in November 2011, a number of initiatives, programs and projects have been completed, are on-going, or are in the initial stages of implementation.

The Action Plan was always intended to be a "living document" that incorporates new information and technology, as well as assesses the impact of completed projects and on-going programs for water quality improvements in the May River, allowing further refinements to the plan as needed. This adaptive management and holistic watershed assessment approach is reflected in Figure 1, the iterative "Step #6 Measure Progress and Make Adjustments" of the EPA's handbook to develop watershed plans (EPA, 2008). This is described as an "iterative" process as it is routinely implemented to improve the plan and its intended short-term and long-term outcomes.

The benefits of the adaptive management strategy and several case studies are summarized by the EPA (EPA, 2013) in its most recent watershed planning quick guide. The routine and intensive analyses of pre-determined monitoring data are crucial to the success of any watershed management plan as these analyses ensure the plan is current with industry standards and technical knowledge as well as adapting to a variable physical environment. Additionally, these periodic "check-ups" of a plan ensure that steps toward water quality improvements are being made to meet not only local expectations, but possibly regulatory requirements as well if the waterbody in question is subject to a Total Maximum Daily Load (TMDL).

Applying this assessment to the Action Plan serves as an example of adaptive management of a watershed plan in South Carolina and shares the knowledge with others who face similar tasks throughout the state.

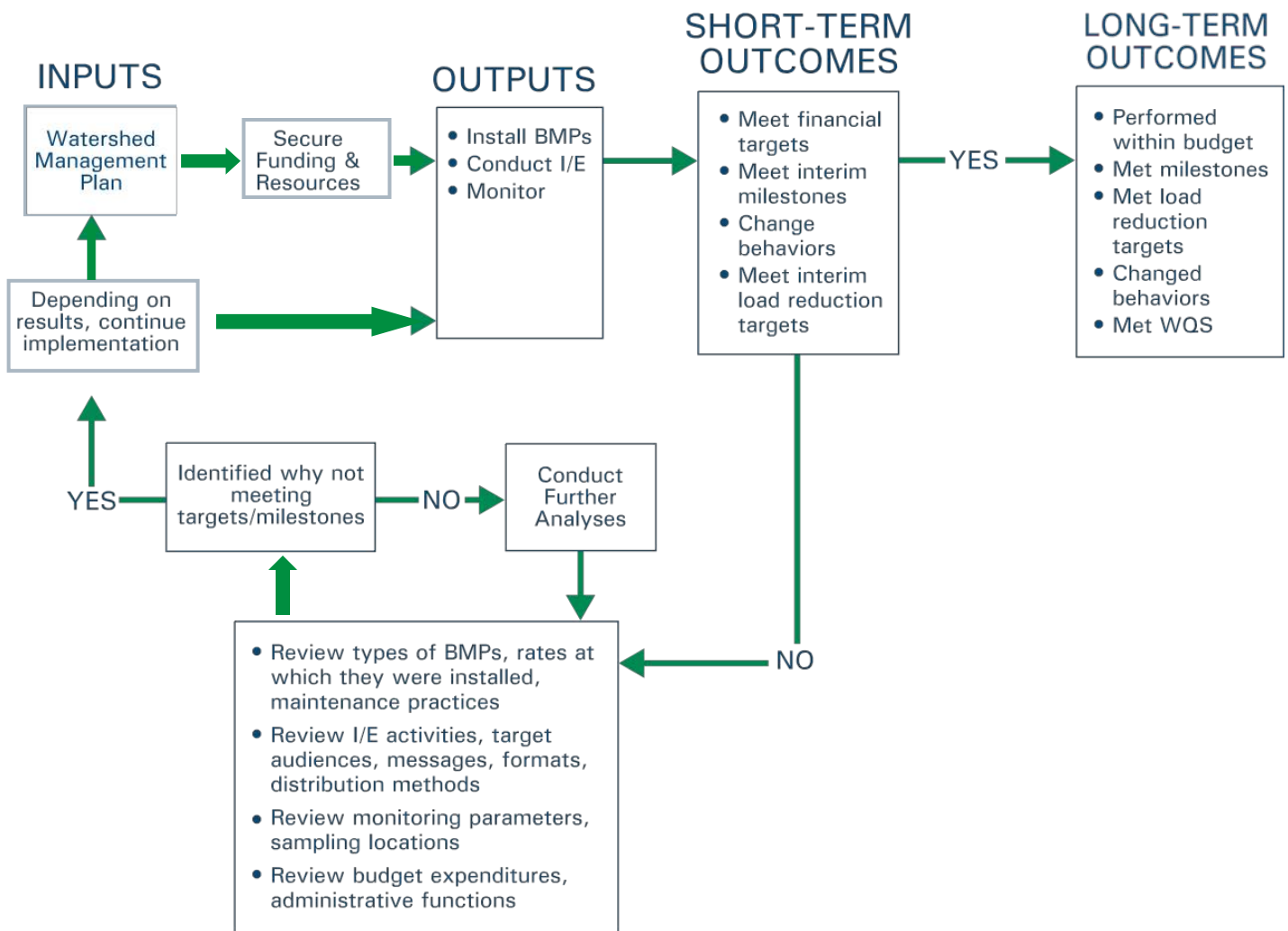


Figure 2. EPA example of an adaptive management logic model for a watershed management plan assessment.

Experimental Design

The Town adapted the EPA guidelines when it created the May River Watershed Action Plan (Jones and Bullman, 2012). The Town intends to continue to follow the EPA guidelines during the adaptive management process and holistic watershed assessment for the Action Plan as programs and projects are completed, or as they continue in the case of on-going programmatic elements. The ultimate criteria utilized to gauge success of the Action Plan is a decrease in fecal coliform concentration numbers at SCDHEC shellfish monitoring stations, resulting in a re-opening of the closed shellfish harvesting beds. This outcome is an indication of holistic watershed health and success of the Action Plan. However, the success of each individual component of the Action Plan will be assessed as well to determine if interim goals, performance measures or statistically significant results are achieved.

Staff, with the input of the six (6) public members of the May River Watershed Action Plan Advisory Committee WAPAC), review the status of project completion and program implementation on a quarterly basis. Now that the first major stormwater BMP project is completed with a year of post-construction monitoring data, a true statistical analysis of water quality monitoring data will be done to assess the efficacy of this particular BMP for our local conditions (Ritchie, 2014).

METHODS

Each of the Action Plan's outputs are assessed objectively to determine if the intended short-term and long-term outcomes are being achieved using the EPA adaptive management approach logic model depicted in Figure 2 (EPA, 2008).

If the intended results are not being acquired, further investigation will occur as to why the performance measures are not being met. The Action Plan will be adjusted as necessary with the guidance and input of the WAPAC and other stakeholders previously identified during the Action Plan planning process. The process will continue for each initiative in the Action Plan until the shellfish beds are re-classified as open for harvesting. From that point, the Action Plan will continue to be assessed using the adaptive management approach to ensure future protection of the May River and its watershed.

RESULTS

Adaptive management analysis results for the Action Plan initiatives from the last three (3) years are presented in Table 1 below. Programs and projects that were part of the Town's first EPA Clean Water Act Section 319 Grant, as awarded by SCDHEC, are fully summarized in the final report to SCDHEC (Jones, 2014).

Applying the adaptive management approach to twenty (20) of the twenty-two (22) Action Plan initiatives listed below (excludes two projects that have just been initiated) indicates that, to date, ten (10) initiatives result

ACTION PLAN INITIATIVES	FUNDING	OUTPUTS				OUTCOMES	MEETING GOALS		CONTINUE?
		2011	2012	2013	2014		YES	NO	
Fecal Coliform "hot spot" monitoring	SWU	1,000 samples	1,000 samples	700 samples	360 samples to date	Provides data to assess project efficacy and environmental indicator for program successes; provides input for future project retrofit areas.	x		YES
May River Watershed Action Plan Advisory Committee	Stormwater Utility Fees (SWU)		formed	meets quarterly to review project progress and performance measures		Provides public forum to gather input into project, programs & initiatives; provides process for quarterly assessment of data and adaptive management of Action Plan.	x		YES
Neighbors for Clean Water - Facebook, Twitter, website	319 Phase I	Brand created; social media sites launched	Continue to engage public via social media			Continued opportunities to reach a broad audience via social media and traditional media venues; conclusion supported by items #1 & 2 below.	x		YES
1. Community Clean-Ups		3 events; 100 volunteers; 1.6 tons collected	2 events; 275 volunteers; 1.75 tons collected	2 events; 300 volunteers; 2.5 tons collected	2 events; 300 volunteers; 2.5 tons collected	Community clean-ups will continue and staff will increase participation levels by broadening the scope of the events to be more festival-like.	x		YES
2. Outreach/Education events & participants		30 events; reach of 2,000	40 events; reach of 4,000	50 events; reach of 3,000	In progress	Continued outreach & engagement is necessary for success, however improved performance metrics need to be investigated and adopted.	x		YES
Unified Development Code (UDO) Overhaul based on watershed principles	319 Phase I					Provides a set of standards for development design and environmental protection, but impact is unquantified.	?	?	YES
1. Growth Framework map		adopted	directing future growth and protecting headwaters			Uncertain what impact the Growth Framework Map has had on development patterns on the whole.	?	?	YES
2. Low Impact Development incentives		adopted	available, but not regularly utilized			Uncertain what impact the incentives have had on development designs; requires better promotion of availability and tracking in the development		x	YES
3. Stormwater Volume Control requirement		adopted	requires post-construction stormwater run-off volumes to equal pre-construction levels			Uncertain what impact the volume requirement has had for protecting receiving waterbodies; requires calculation of percentage of stormwater volume decrease compared to previous design requirements.	?	?	YES
4. Transfer of Development Rights			1,300 units transferred; prevents 146 acres impervious surface in headwaters			While this program was effective in this single case, it needs to be more broadly promoted and applied.	?	?	YES
Rain Barrel (55-gallon)	319 Phase I	175 installed				Increased awareness and engagement for 150 homeowners (several sites received multiple barrels); prevented additional run-off from home sites.	x		YES
Rain Garden (~70 sq. ft. each)	319 Phase I	13				Not the most effective stormwater BMP due to cost & maintenance needs making homeowners reluctant to participate.		x	NO
Doggie Dooley Pet Septic installation	319 Phase I	5 installed in support of "scoop the poop" pledge campaign; 30 pledges made				While this small-scale program was used as an incentive to have pet owners sign a "scoop the poop" pledge to be eligible to win a Doggie Dooley, only 30 pledges were made.		x	NO
Manure management plan & buffer garden	319 Phase I		250 sq. ft. garden installed			This particular project stabilized the soil and provided filtration of runoff. Wide-spread application of this BMP would be time consuming and costly.	x		AS NEEDED
Bird Roosting Deterrent for docks	319 Phase I		40			Homeowners were reluctant to deploy a roosting deterrent due to their appearances.		x	NO
Septic Maintenance Assistance	319 Phase I & SWU	82 service requests	98 service requests	19 service requests	12 service requests to date	Until sanitary sewer service is extended to most residents, this program is necessary for environmental and health/safety/welfare of the public.	x		YES
New Riverside BMP Pilot Project	319 Phase I			1.25 acre lagoon; 300 acre sub-basin treated	1 year of monitoring data show a 75% reduction in fecal coliform concentrations	The efficacy of a pond to reduce fecal coliform loading from an undeveloped drainage area is currently being investigated via the monitoring data. Dependent upon these results, the applicability of this type of BMP in similar conditions will be known.	?	?	?
Animal Waste Ordinance completed	General Fund	adopted; 1 ticket written and dismissed by judge	no tickets written			Widespread education in support of this ordinance needs to be conducted for police officers, judges and general public to increase its effectiveness as a BMP for fecal coliform reduction.		x	YES
Trash can installation in Old Town	Palmetto Pride Grant	6				Trash cans are emptied weekly and more frequently after festivals, thus preventing debris from entering the river.	x		YES
Construction Site Sediment & Erosion Control inspections	SWU	200	400	2,000	700 to date	Sediment and erosion control inspections are effective to prevent sediment transport of pollutants to receiving waterbodies.	x		YES
Pine Ridge Retrofit BMP	319 Phase II				initiated	The efficacy of a stormwater BMP retrofit to an existing system to meet the current volume control requirements will be assessed via monitoring stormwater re-use for irrigation.	?	?	?
Wetland Restoration impact assessment	Capital Improvement Program				initiated	The potential impact of a wetland restoration project to improve water quality downstream is currently being investigated.	?	?	?

Table 1. Results & adaptive management for the May River Watershed Action Plan.

in outcomes considered to be a positive improvement for water quality. The outcome of five (5) initiatives are not considered to be meeting the goal of improving water quality, and five (5) initiatives require modification and re-assessment to determine if their outcomes are contributing to water quality improvement.

The vast majority, fifteen (15) of the twenty (20), initiatives are considered worth continuing, whereas four (4) initiatives – rain gardens, Doogie Dooley pet septic installation, bird roosting deterrents, and buffer gardens – were not considered worth continuation, or only on an “as needed” basis, due to poor public response or participation as well as limited water quality improvements in spite of high staff effort or monetary requirements.

The remaining initiative is a recently completed stormwater BMP, the New Riverside Pilot Project Pond. A year of monitoring data has been collected on this BMP and is currently being analyzed to assess its effectiveness in reducing fecal coliform concentrations in an undeveloped drainage basin with naturally high levels of bacteria.

The two (2) excluded BMPs are in the initial stages of implementation. However, pre- and post-construction monitoring data will be collected to determine their contributions to water quality improvements.

DISCUSSION

Assessing the Action Plan using the adaptive management logic model indicates that half of the initiatives are resulting in outcomes considered positive for water quality improvement. What is striking is that half of the initiatives are believed to be producing positive results, but require different and additional monitoring and assessment to support this assumption. All of the initiatives require a quantitative assessment of contributions to fecal coliform load reduction.

The adaptive management approach also provides insight into which efforts are worth continuing, as well as which ones may not be worthy of continuing. For those projects/programs that continue, it is clear what additional data are needed to most efficiently reach the goals of the Action Plan.

Lastly, the analysis will provide guidance on what projects are most effective for our watershed conditions.

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Mayor Pro Tempore Ted Huffman; members of the May River Watershed Action Plan Advisory Committee; past Town Manager Anthony Barrett; and the dedicated and talented staff of the Town of Bluffton, especially James Ayers, Jeremy Ritchie, Carl Norris, Alex Leinbach, Bill Baugher and Beth Lewis; and the Bluffton community.

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